

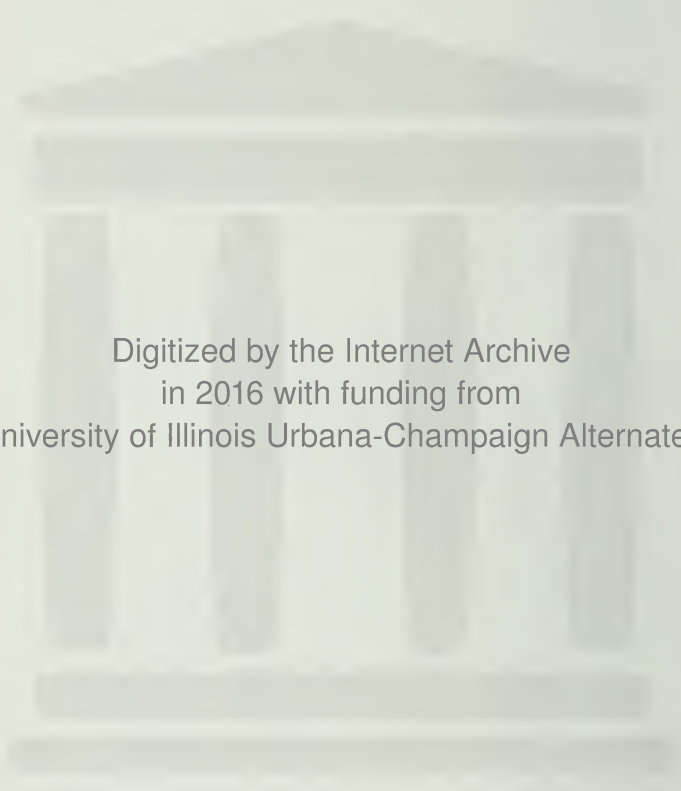
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EXPERIMENT STATION

BROOKINGS, S. D.

Bulletin No. 23.

APRIL, 1891.

DEPARTMENT OF FORESTRY, HORTICULTURE
AND BOTANY.

Forest Trees, Fruits and Vegetables.

PRESS PRINT, BROOKINGS.

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ARBOR DAY.

The proclamation of the Governor, designating the first of May as Arbor Day, is printed herewith. Governor Mellette urges the general observance of this holiday with such force and judgment that comment is unnecessary:

"Whereas, the ceremonies of Arbor day, which are generally observed throughout the states by setting apart a day annually for the planting of trees and the dissemination of knowledge of forestry and statistics pertaining to the importance of the problem of the world's future timber supply, has become a custom in South Dakota,

Now, therefore, I, Arthur C. Mellette, governor of South Dakota, do hereby designate and proclaim Friday, the first day of May, 1891, to be observed as Arbor day in South Dakota.

"Teachers should take this occasion to impress upon pupils the necessity of timber to civilization, besides its important climatic influence, and utilize the day by planting trees upon public grounds and providing for their culture. Parents and children should observe the day by planting trees about their homes and private grounds. Citizens should give the subject recognition from a public standpoint. I especially invoke the aid of the press, the great lever of modern power, in aid of the proper observance of the day and the benefits sought.

While the subject is attracting the attention of those States still possessing great areas of natural timber, it is doubly important to the State of South Dakota, practically devoid of natural timber, and within which artificial forests are readily produced by the aid of experience and skill. It has been written that he who plants a tree has not lived in vain. Its shades delight and its branches protect coming generations. The nation and the state alike, by legislation, encourage tree culture. It is for people to decide, and they should bring to the work the energy which it deserves.

Done at Pierre, the capital, this 3d day of April, 1891,

[SEAL.]

ARTHUR C. MELLETTE, Governor.

By the Governor:

A. O. RINGSRUD, Sec. of State.



FOREST TREES, FRUITS and VEGETABLES.

CHARLES A. KEFFER, HORTICULTURIST.

This Bulletin contains suggestions for methods of planting forest trees, street and lawn trees, orchard and small fruits and garden vegetables, with notes on varieties suitable for cultivation in South Dakota.

In April, 1888, a Bulletin on "Arbor Day: Why to Plant, What to Plant, How to Plant" was issued by this Station. Since that time thirteen acres of forest trees and about six acres of fruit trees have been planted at the Station, and thus a beginning has been made in sylva-culture and orcharding.

The drouth of the past two years has merely emphasized the need of a forest area in this treeless region. Nebraska planters generally, and individual planters throughout South Dakota, have conclusively proven that trees can be grown with less moisture than corn. We must regard our trees as pioneer crops to be established at the earliest possible time, so that the farm fields may be protected from dry winds, and that the snows of winter may be saved for the growing crops.

I have been interested in observing the action of groves as snow catchers. During the last snow storm the small trees in Station plantation, set in the spring of 1889 and averaging not more than four feet high, caught the snow so that a drift two feet deep and covering about two acres was formed among them. The fields of the Station slope slightly from the trees. After the snow was melted on the open fields, the drift remained among the trees, melting more slowly, because shaded by the tree tops. As the snow melted the water was absorbed by the dry earth, and none was wasted. A more striking instance of the value of trees as water-savers was observed in 1890. While driving along a country road several miles north of Brookings, I noticed

a grove planted on the crest of a ridge; a plowed field sloping from it toward the highway. The snow was melting rapidly, and the water from a drift that had formed among the trees, could be seen moistening the entire field as it sought the lower levels.

These instances, coupled with the present interest in irrigation or other water supply for crops, have impressed upon me the value of forest trees in this connection. If the heights of the farm can be planted with trees that will catch the snow, a great saving of moisture to the adjacent fields can be effected. The plan has been tried many times, and has been commended in several letters received the past year. But usually the trees are placed on low ground, and this benefit has thus been lost. Most trees grow best on low land, but if the ground is well prepared and if the trees are given good cultivation they will succeed in the higher places.

GROVE PLANTING.

All necessary preparation should be made before the day for planting trees arrives. The land should be plowed twelve inches deep. Of course, it is best to reach this depth by turning up new soil gradually, going an inch or two deeper for four or five years. It is doubtful if very deep plowing on new land is ever advisable. It requires at least three years of thorough culture to kill the wild growth of prairies. During these three years land broken two inches deep can be plowed four, six and eight inches, though many excellent farmers advocate a more gradual deepening than this. However, if care has been taken to kill all the wild roots—particularly of the prairie grasses, four inches or even six inches of new soil can be turned for trees in order to reach a depth of twelve inches, when for almost any other crop, such a depth of new soil on the surface would not be advisable. In case it is necessary to turn four or six inches of new soil, it is very desirable that the work should be done early in the fall, so that the frosts of winter can disintegrate the solid earth thus turned, and the air can permeate it thoroughly. In the spring careful harrowing is advisable, so that the land shall be in the finest tilth when planting time arrives. Fall plowing is always

best for trees, but the work may be done in spring, and oftentimes with good results; the peculiar conditions of each year having always to be considered.

CLOSE VS. WIDE PLANTING.—The distance at which to plant trees apart seems a subject of controversy. The Manuals of the Minnesota and Iowa horticultural societies advocate close planting and this is the practice of Europeans foresters. It should be the object of the planter to make his grove independent as soon as possible. This seems of especial importance in this State, where help is scarce and each man depends largely on his own efforts for all the work of the farm.

The advantages of close planting are manifest. Trees planted three or four feet apart, if of proper varieties, shade the ground so completely in their fourth or fifth year that it is impossible for grass and weeds to grow beneath them. Thus the period of cultivation is materially shortened. Close planted trees serves as a protection for each other and form straight, clean poles, which are free from knots and make the best kind of timber. They also make a much better wind break than trees planted from six to ten feet apart, because they quickly become massed, the branches touching one another.

The principal disadvantage of close planting is the necessity of early thinning; if the trees are allowed to stand too long they are thought to exhaust the soil and thus the great majority of them die and the planter has little to show for his labor. But there seems to be a misconception on this point also. Trees will grow longer without thinning than is popularly supposed. There is a plantation on the grounds of the University of Illinois which was close planted, and had not been thinned when the trees stood from twenty-five to forty feet in height. Doubtless a somewhat better growth would have been secured had a first thinning been made sooner, but the excellence of the stand and the thriftiness of the trees when examined, showed they had not materially suffered. It should be remembered, too, that thinnings from a grove of trees twenty feet in height, can be used for fuel. Probably the cost of such fuel would prevent its use in more favored regions, but the State of South Dakota is remote from coal fields, and fuel is one of the heaviest items

of the farmer's expense account, unless hay or straw is used. There can be little doubt, then, that the value of the thinnings from a close planted grove will repay both the added first cost of trees and the work of thinning.

One of the greatest objections to wide-planting is the form of tree resulting. Trees planted six to twelve feet apart, either in squares or rows, will make a lateral growth at the expense of height growth. The greater distance encourages the development of lateral branches, and of the division of the trunk into forked branches near the ground. Such branches are of very little economic value. Their worth for fuel will hardly pay for trimming and they have no other use. The formation of many laterals necessitates far more pruning than would otherwise be necessary. The trees, having light on every side, are more apt to be crooked, and hence of less use as timber, than where close planted. Probably more wood is formed in wide planted than in close set groves, if we consider trigs as well as trunks, but certainly less available timber is formed in wide distance plantations, and it has less value for farm or commercial uses. When in addition to the above, we consider the several years of extra cultivation necessary, the balance would seem to be decidedly in favor of close planting.

MIXED PLANTING.—The Station has advocated mixed planting as against the use of a single variety in every Forestry Bulletin that has been issued. This is not only the universal practice of all authorities on tree growing, but it is the method of nature. It is much less trouble to plant an entire grove of one variety of trees, and where the stock must be purchased the planter is liable to be controlled by considerations of price rather than utility. The availability of certain species—as cottonwood, willow, ash and box-elder, has had much to do with the making of groves exclusively of one of these varieties. The intending planter should consider the problem, "How can I most quickly get the best grove for the least money?" He will see that the trees that grow most quickly are not of the highest economic value; but he will recognize their great utility in the making of a leaf canopy, and he will be lead to use rapid growing trees for the greater part of his plantation, with more valuable forms inter-

mixed. A mixed plantation presents an uneven sky line to the winds and forms a better barrier against them. More trees can be brought to maturity in mixed than in homogeneous planting, as the intervals between the taller growing sorts are well adapted to certain shade enduring kinds. In many cases, too, the varieties that are of rapid growth in youth are overtaken and passed by others which are of very slow growth, and which need protection, while young. This is true of such sorts as box elder with the walnuts and oaks. The very great majority of trees used in a plantation should be of a quick growing kind with dense foliage, so that the ground may be shaded as soon as possible, and weed growth thus prevented. Among these, at intervals from twelve to sixty feet, slower growing sorts of greater economic value can be placed. By this arrangement cultivation is only necessary four or five years, and the "nurse" trees (the rapid growing kinds) will have compelled the slower growers of greater value to reach upward for light, and thus grow a straight trunk. The rapid growing kinds are then removed as needed. In all prairie planting, the greater part of the forest should be composed of trees with good foliage, rather than of such varieties as cottonwood, which do not make a dense shade no matter how closely they are planted.

By close mixed planting height growth is first secured. As the trees are thinned, however, especially if the final removal of nurse trees be deferred until the height growth is almost attained, the diameter of the boles increases rapidly, and usable timber is secured more quickly than by more open planting.

Another advantage of mixed planting, and one that is of the first importance, is the relative freedom from insect ravages in mixed plantations. If the mixture includes some fruit bearing trees, like the wild cherries and plums, birds will be attracted by them, and these friends will prove the most valuable insect destroyers about the farm. Usually an insects attacks but one or two species, and so in a mixed grove there would always be many trees that would escape.

It is not necessary or desirable in mixed plantations, that there be same number of trees of each species. One species, such as box elder, or in parts of the State where it is available

the native Spruce (*Picea alba*) should form at least three-fourths of the plantation, and the remaining one-fourth could be mixed at intervals of twelve feet among the predominant variety. This one-fourth should consist of trees of the greatest economical value, hence ash would form a large part of it. Elm, black wild cherry, the walnuts (in some localities), burr oak and in the borders of the plantation, the wild plum could be used with profit.

GROWTH OF TREES FROM THE SEED.—The question is often asked: Is it best to plant forest tree seed where the trees are to stand, or to plant one year old seedlings? The answer will depend upon circumstances. If good seed could be planted late in the fall, in moist soil, and if the surface soil could then be kept from blowing off before the warm days of spring, probably a good stand would be secured. But even then the care of the plantation would be much more expensive than where seedlings are used, as more handweeding would be necessary. The use of trees is to be preferred, then, not only because they are more easily cultivated the first and second years, but, generally, a better stand is secured. Seedlings can be cultivated most economically by planting the seeds thick in drills three inches wide and three feet apart. Close sowing in the drill will force the seedling to grow tall and thus make it easier to handle in planting. It is true that thin seeding in the drill will make stronger trees, but usually they will be plenty strong enough to transplant at one year old where sown thickly in drill.

The seed of silver or "soft" maple (*Acer dasycarpum*) and White Elm, *Ulmus Americana*) both of which are native along Dakota streams, ripen almost as soon as the leaves expand and should be sown immediately, as they lose their vitality by being kept a year. The seed of cottonwood should also be sown as soon as ripe. Seeds of black, wild cherry, green ash, white ash, box elder, the acorns and nuts, should be gathered as soon as ripe in the fall, and placed where they will freeze and remain frozen, if possible till planting time. The smaller seeds are usually mixed with moist sand before freezing, and the larger ones may be given the same treatment, or spread in thin layers

and covered with boards or straw. All should be stored in a well drained, shaded place, where frost remains late in spring. I have had much more satisfactory results by freezing seed and planting in the spring than by fall planting. Fall planted seed are apt to germinate early, only to be killed by subsequent hard frosts. Rich, warm soil should be chosen for forest tree seeds. Sown in drills as early as possible in spring, in well prepared land, enough trees can be grown on an eighth of an acre to plant several ten acre groves. The farmer will find this treatment more satisfactory than planting the seed where the trees are to stand and more economical than any other.

The oaks and walnuts are more difficult to transplant than other species, and these will oftentimes succeed better when the seed is planted in the grove. This can be most easily done by leaving the places for such trees blank while planting, and in the fall putting in two or three nuts or acorns in each place. They should be covered to a depth of two or three inches, to allow for wind action.

STREET AND LAWN PLANTING.

The ideal street tree is one that has a straight, clean trunk with a well formed head and dense foliage. It must be able to stand neglect, and must thrive under adverse conditions. It should be as free from insect pests as possible. It may either have a compact, rounded head, like the hard maple, or may have extended branches, like the graceful elm. Its principal purpose is to shade the walks and drives, hence dense foliage is important. The list of valuable native trees, suitable for street planting is very limited.

METHODS OF PLANTING.—In planting street trees, it is important to dig large holes of greater depth than would seem necessary for the tree. The surface soil should be kept separate from the subsoil. Good, moist, black soil is put in the bottom of the hole and about the roots, the subsoil being used in filling up. The soil should be tramped firmly about the roots and it is often best to pour on a few pailsful of water in order to bring it in close contact with the roots. As soon as planted each

tree should be liberally mulched with straw or other litter. Before planting any bruised roots should be pruned with a clean cut, the cut surface to be on the under side of the root. If dry the roots should be plunged into water, but of course it is best never to let the roots of trees become dry.

The amount of top pruning depends entirely upon the condition of the roots where the tree is ready to set. In this dry climate it is necessary to cut back more severely than in the Eastern States. It will always pay to cover the wounds made in pruning with wax, clay or paint, grafting wax being the best material. When tall trees are used, they are made more sure by wrapping the trunk with old cotton cloth or paper, which may be wet occasionally until the tree is established. This treatment serves the double purpose of preventing evaporation and lessening the liability to sunscald.

All the trees in a street should be set at equal distances from each other. And by far the best effect is secured by planting an entire street with one species, especially if all of the trees in it can be of about the same size and planted the same day. In this way with the full development of the trees the bare street will be transformed into a beautiful avenue. No better celebration of arbor day could be devised than for all the property holders on a village street to unite in planting their road way with trees as above indicated. Many of the streets in the city of Washington have been planted in this way, elm being used for one avenue, basswood for another, maple for another, etc.; great variety and beauty has resulted. Necessarily our range of choice is limited, but even with the few suitable species we have a great improvement could be made in street planting.

In small lawns trees and shrubs are best set regularly, but in large lawns, school grounds or parks, groups of irregular shape with curved outlines are more pleasing. Such groups are usually placed at the junction of walks, or to hide unsightly objects, but they should always leave room for broad stretches of grass between. The proper grouping of trees and shrubs is a difficult art which cannot be outlined in a brief Bulletin. Successfully accomplished, nothing can be more pleasing than groups of plants properly proportioned to the size and shape of

the lawn, but anything short of complete success is apt to be a failure.

In lawn planting, as in street planting, the roots of trees or shrubs should be freed from all bruises by pruning away the injured parts. Rich top soil should be placed among the roots, which must be given their natural spread, and all plants should be set firm. It is best to keep the soil near transplanted trees free from weeds and grass. If the plants are mulched, the mulching can be removed at intervals and a good hoeing will prove useful, after which the mulch should be replaced.

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VARIETIES.

FOR GROVE PLANTING.—In discussing the relative value of varieties, it is essential to keep in mind the purpose which the tree is designed to fill, and its adaptability to the peculiar conditions of the locality in which it is to be planted. This is most important for the new-comer, because South Dakota differs greatly in climate from the older settled parts of the country. As an advocate of mixed planting, I have not had occasion to search for a "general purpose tree," and it is doubtful if such a thing exists for Dakota. We have two distinct needs, and they are not met in any one species, a quick growing tree that will soon give us protection, and a valuable timber that will relieve us of the expense of high lumber rates.

RAPID GROWING VARIETIES—COTTONWOOD (*Populus monilifera*).—This tree has been used more than any other in the plantations of the western prairies. It is hardy, is the most rapid grower of any of the natives, is propagated readily either from seeds or cuttings, and makes fire-wood more quickly than any species. It reaches its highest development south of this state, but under favorable conditions it attains large size here. The most favorable locality for cottonwood is the rich bottom lands of streams, but it is successfully grown on high prairies. There are several serious objections to cottonwood for close planting. It is not a dense foliage tree and never makes a sufficient shade to prevent weed growth. This is the most serious defect in the tree, because it makes it unfit for the principal pur-

pose to which a rapid growing soft wooded species can be applied. The wood is of very little value either for fuel or farm uses. It is not durable used as fence posts or poles, is not strong, warps badly when made into boards. Cottonwood is a rank feeder and is not a good neighbor for other and more valuable sorts. The cottonwood leaf beetle has done immense damage to trees in many parts of the state and the pest is rapidly spreading. In the dryer parts of the state the cottonwood is proving a short-lived tree. In the presence of all these objections its one great virtue of rapid growth is hardly sufficient to warrant its use in groves. Cottonwood is easily grown from cuttings.

THE RUSSIAN POPLARS.—A number of these varieties of the genus *Populus* have been tested in the state, but as all are subject to the attacks of the cottonwood leaf beetle their value is questionable. With this pest out of the way the Russian *Populus certinensis*, *P. pyramidalis* and *P. Nolester* have proven trees of very rapid growth, and all are said to yield a timber of greater value than the cottonwood. The Russian poplars while not common, are offered for sale by several nurseymen in this State, Minnesota and Iowa. They are only known as yet by their scientific names.

THE WHITE WILLOW.—This tree has been largely planted as a wind break, for which purpose it is peculiarly fitted by reason of the great number of branches which extend from the ground along the entire stem. It is of rapid growth, especially in moist situations, and of easy culture. The timber is regarded as of rather more value than cottonwood. It does best in moist soils, but is successfully grown on uplands. It is not a good tree with which to hedge an orchard, or to plant where it is desirable to crop the land adjoining, as it is a gross feeder and its surface roots spread wide on every side.

Of late, in this vicinity, the elm sawfly has denuded the willows of their leaves, making them very unsightly and checking growth seriously. The larvae succumbs readily to arsenical spraying. The willow reaches a higher degree of development in central Iowa than in central South Dakota, but it can be grown here. It is not so well adapted for mixed planting as other species, ranking with cottonwood for this purpose. It is

used most effectively as a screen or wind break. It is propagated from cuttings.

RUSSIAN WILLOWS.—A number of varieties of the willow have been imported from Russia which give promise of usefulness in this State. Among the best of these is *Salix fragilis*, a red willow, and a variety sent out by the Iowa Agricultural College as No. 106 Vor., this latter is very ornamental, having bright yellow twigs. Among other forms grown only for ornament may be mentioned the Laurel Leaved Willow and *S. Napoleonis* a trailing or weeping form.

BOX ELDER (*Negundo Aceroides*).—This tree has more of the elements of a valuable nurse tree than any of the native species. It is a rapid grower while young, is a good neighbor, can be easily grown from seed which can be secured along the streams of the state, and when five years old, planted four feet apart both ways, trees of this variety will shade the ground so completely that further cultivation is unnecessary. It is comparatively free from insect enemies. Its leaves decay more readily than those of cottonwood, and it is hence a soil improver. With good cultivation it grows rapidly while young in either high or low land, and its slower growth with age is an advantage in mixed planting, as it is a shade enduring tree and will live in the shade of more valuable kinds that are of slower growth in youth. The wood of box elder, while regarded by many as making better fuel than cottonwood, is not greatly superior to it for other purposes. Sugar has been made from the sap of box elder in quantities sufficient to warrant a further trial of the experiment. In quality box elder sugar is said to be equal to that made from hard maple.

SOFT MAPLE (*Acer dasycarpum*).—This species is common in the native groves along the rivers in the Southern part of the State, but is less common in the central part and almost disappears at the north. Where perfectly hardy it is as good a soft wooded, rapid growing tree as we have and can be substituted for box elder to form the greater part of a grove. It retains the habit of rapid growth later in life than box elder, and does not endure shade quite so well, and hence is not quite so desirable as a nurse tree. In the central part of the State it winter kills,

while young at least, and several shoots spring from near the ground, necessitating careful pruning in order to get one straight trunk.

• This pruning is troublesome and requires considerable time, making the cultivation of the species more expensive than box elder. In the northern part of the State silver maple is not hardy and should not be planted. It is comparatively free from insect enemies. It is as good for sugar making as box elder and rather better for fuel. When a grove of only one rapid growing species is desired, soft maple will prove useful in the southern part of the state, but north of Brookings county its cultivation, save in favored localities, will not prove profitable.

SLOWER GROWING VARIETIES—Green Ash (*Fraxinus viridis*)—This tree has been more uniformly successful in prairie plantations than any other. When planted among box elder it equals that tree in height at the end of seven years, and there after is the more rapid grower of the two. It is best planted with box elder, as it does not make a dense shade, and when planted alone weeds and grass will materially check the growth of the trees. Green ash wood is only second to white ash in value for repairs about the farm. As the tree is native here it will probably succeed better under cultivation than white ash, which is rarely found native in South Dakota, unless in the extreme southeastern part of the State. It does not grow as large as white ash but reaches small saw-log size. The great value of the tree seems to be in its ability to withstand heat and drouth. In this vicinity the ash tree borer is becoming very common. It works in the trunks of the trees, and so weakens them that the winds break them down. It will probably be less troublesome in mixed plantations than in isolated trees or groves composed exclusively of ash.

WHITE ELM (*Ulmus Americana*).—The white elm seems to have fewer insect enemies than any of our native trees, and as it succeeds in both high and low lands it should be extensively planted. Trees in the mixed plantation at the Station have on the average made a better growth than green ash. While young the elm has a tendency toward forked branching, but if the trees are set close one of the branches usually gets the start of the

other, and a straight bole results. The Elm wood can be substituted for ash for many farm uses, and it is especially valuable when a tough timber is desired. When dry it is a fairly good wood for fuel, but not equal to ash.

The Red or Slippery Elm (*Ulmus fulva*), is recommended very highly by Iowa planters, but I have not heard of it yet in Dakota plantations.

BLACK WILD CHERRY (*Prunus serotina*).—This species is most successful on deep, rich soil, but succeeds well enough on high land to deserve a place in every grove. It is unnecessary to mention the high quality of its timber, which almost equals Black Walnut for cabinet making. Its peculiar value to the South Dakota planter lies in its fruit, which is greatly relished by birds. A grove that contains a number of fruiting wild cherry trees is apt to be comparatively free from insect ravages, as the birds that are attracted by the fruit will usually keep down the insects. The fruit is liked also, by many people, and is very healthful.

The tree is not quite hardy while very young, the tips of the branches of three-year-old trees killing back at the station, but like the soft maple, it becomes more hardy with age.

It has been fruited for three years in Grant county, and is worthy of extended trial in all parts of the state. It is an attractive species throughout the season. In June it is covered with sweet scented white flowers, which are followed by hanging clusters of dark colored fruit, while throughout the season the foliage is a rich, sprightly green color.

HACKBERRY (*Celtis occidentalis*).—This is a tree that is seldom seen outside the native groves of the state, where it is common. It deserves a place in every plantation if for no better reason than its beauty. It is one of the best native fuel woods, and while delighting in damp soil has been grown successfully on upland.

The fruit may be gathered from trees in the natural groves in the fall, mixed with sand and frozen over winter and planted

in spring, either in nursery rows, or where the plants are to stand.

THE WALNUTS (*Juglans nigra* and *J. cinerea*).—No mixed grove would be complete without the black or white walnut. The black walnut can be grown as far north as the central part of the state, and the white walnut or butternut will range somewhat further north. Both species—the black walnut particularly—do best on the deep soil of low lands along the streams, but they can be successfully grown on ridges where there is good depth of soil. The walnuts are greatly benefitted by planting among more rapid growing trees, which compel them to reach up for light, and thus grow straight and tall. Where planted alone they form many lateral branches and are scrubby, but where “nursed” during infancy they follow the form assumed in the native woods.

The timber is of the highest value. The black walnut has been so thoroughly cut in the forests of the country that it is extremely scarce and is every year becoming higher priced. It can not be expected to thrive in this state as it does farther east and south, but it is one of the trees that should be planted for posterity.

THE OAKS.—(*Quercus macrocarpa*) Burr Oak, and (*Q. nigra*) Black Oak.

South Dakota is fortunate in having in its native groves one of the most valuable species of the entire oak family—the burr oak. It is very durable when in contact with the soil, and can be substituted with advantage for the more commonly used white oak in all cases.

Another species is native in this country, belonging to the group of which jack or black oak may be taken as the type. This is much inferior to burr oak, though a more rapid grower while young. The oaks are cultivated in the same manner as the walnuts. They are of very slow growth while young, and therefore not suitable for planting alone. Planted among other trees, while making top very slowly, their root system is strengthening and in time they grow much faster above ground.

It is best, both with oaks and walnuts, to place them at wide

intervals in the plantation, so that no appreciable opening for weed growth is left, as would happen if a group of them were made. It is important to keep the value of dense leafage constantly in mind in planting a mixed grove.

SMALLER TREES.—In natural forests we find as great variety in sky line as in grouping, caused by mixture of tall growing and low tree forms. Usually the openings among the high trees are occupied by shrubs, like wild gooseberry, dwarf Juneberry, currant, sand cherry, or the larger choke cherry; and in more open woods, and in the borders of groves, by the wild plum, hawthorn, and similar low growing forms. And so in our artificial groves all these things may have a place. Their value as timber is of course nothing, but the birds love them, and they make a more complete soil cover. The fruit of the wild plum is valuable, and by top grafting seedlings of the wild stock, any one can have in the borders or openings of his grove, plums of the best quality. The other plants mentioned furnish fruit for birds, and these friends should not be forgotten, for they are the best insect exterminators that can be brought to the farm. In addition to these arguments in favor of including small trees and shrubs in the forest plantation, is the constant one of additional beauty and variety to the grove, and consequently greater attractiveness for the prairie home. Many open groves can be gradually improved by the introduction of low woody plants, which succeed in the shade of other trees, where timber forms would fail.

STREET TREES.

The varieties that seem best adapted to street planting are white elm and box elder, the elm being the finest street tree that is native to the temperate zone. Cottonwood grows better in single rows than in close plantations. To many it is an attractive form, and where the cottonwood leaf beetle has not appeared it makes a fair street tree, though never giving the dense shade of box elder. Silver maple ranks next to white elm and box elder as a street tree, and will be found satisfactory in the southern half of the state. It is apt to throw out strong "water sprouts" near the crown, which are sometimes difficult to get rid of. In

low moist land the basswood or linn makes an excellent street tree. Towns lying on river banks will find this species desirable as affording an agreeable variety in form and foliage. The black wild cherry is not as useful for the street as for lawn planting. It is apt, when standing alone, to grow crooked, and street trees should have straight clean trunks. The ash, though often used in street planting, is one of the least desirable species for the purpose. When planted in grass as most street trees are, it grows very slowly, its shade is light, and trees of a good size for street use do not bear transplanting as well as elm or box elder.

LAWN TREES.

For lawn planting the range of choice is much greater than for street use. In addition to the species suitable for street planting, the ash, hackberry, white birch, cut leaved birch, Russian silver poplar, laurel leaved willow, buffalo berry, (*Shepherdia argentea*,) wild plum, wild and cultivated crabapple, hawthorn, and the wild cherries, all can be grown in any part of Dakota where a sufficient water supply is to be had. No trees do so well planted in grass as in cultivated land, and this is especially true in dry regions. Hence the slower growing trees and the species named in this paragraph particularly will be profited by occasional thorough watering when set in the lawn. All the trees mentioned are native except the birches, Russian silver poplar, laurel leaved willow, wild crabapple, and the Siberian crabapple, the last being a well known fruit tree. The wild crabapple is a native of eastern Minnesota, and is hardy in the vicinity of Brookings. It has pink colored fragrant blossoms and in blooming time is a very ornamental tree. In size it is but little larger than the wild plum. Several silver poplars were imported from Russia by the Iowa Agricultural College. Of these the most ornamental is *Populus boleana*, which has deep lobed-leaves, the under side being clear white and the upper side dark, rich green. The tree is erect in habit and is a valuable addition to the list of ornamentals. It is not quite so much damaged by the cottonwood leaf beetle as are others of the genus. The laurel-leaved willow is also a Russian. It is a tree of small size, compact, rounded

form, having beautiful shining foliage. It also is subject to the attacks of the cottonwood leaf beetle.

The birches are native far north, but they prefer a cool, damp atmosphere, and may not, for that reason, prove successful in all parts of the state. Many trees have died in the college lawn, but those that survive are in fine condition. There are a few fine specimens of cut-leaved birch growing in Brookings.

Among the flowering shrubs which may fairly be entitled to a share of attention in lawn planting, the following have proven hardy at this Station: White, common and Persian lilac, mock orange or syringa, snowball, *Spiraea opulifolia* and *Spiraea Van Houtii*, flowering current, purple-leaved and common barberry, wahoo, snowberry, rugosa rose and other roses.

EVERGREENS.

At the last meeting of the State Horticultural Society held at De Smet in December, 1890, a number of fine specimens of conifers were exhibited. They were grown in the drouth-stricken part of Kingsbury county, but in spite of three years of unprecedented dry weather some species showed fine growth and all were in the best condition.

In the Station grounds the growth of several conifers has been excellent, and there would seem to be no good reason why at least three species should not be included in the plantations of the state, and probably five varieties can be successfully grown as lawn trees over the larger part of the state. The hardiest of the evergreens seems to be the Scotch pine, and it is also the most rapid grower, at least while young. The red cedar and the white spruce, in addition to the Scotch pine, can be grown in any part of the state. Red cedar is native along the Missouri bluffs, and the white spruce is one of the principal forest trees of the Black Hills.

In addition to these species, which should be generally grown throughout the state, balsam fir, Norway spruce and arbor vitae may be successfully cultivated in the southern counties. Colorado blue Spruce is quite as hardy as white spruce, but it is a high-priced tree. It can be safely recommended as a fine species for the lawn.

The following suggestions on the management of evergreens are taken from our Bulletin No. 3:

1. If possible get your trees of a Dakota grower. The home nurserymen should be patronized in all cases where possible, but it is especially important that coniferous trees be purchased as near home as possible. If you can, drive to the nursery, with a wagon box full of straw and old rags or sacks, and select your trees, having them dug with care.

2. From the time the trees are taken up until you set them, do not permit the dry air to strike the roots if it can be avoided. This is essential. Have wet straw at hand, and as soon as the trees are out of the ground, wrap the roots well in it. Put wet straw in the bottom of the wagon, pack the trees closely, and throw wet blankets or sacks over all.

3. Choose small trees. Trees two feet high are far better than those of greater size, and in five years will be larger than those four feet high when planted.

4. Set the trees firm. Put fine soil in among the roots, shaking the tree to make it fill all crevices; then tramp the ground hard.

5. Mulch deep with coarse litter.

A FEW HARDY FRUITS,

The Station has received a great many inquiries regarding fruits that will succeed in this state. Our experiments with orchard fruits are not yet sufficiently advanced to determine the hardiness of the varieties of apple, cherry, and pear that are being tested, and only a few of the varieties of plum have fruited; hence we cannot base information on our own experiments. There have been exhibited at the state fairs excellent samples of twenty or more varieties of apples and several varieties of crabs. These were nearly all grown in the southern tier of counties of the state, and it would not be safe to base recommendations for the state at large on that favored region. The Duchess is the hardest of the standard apples commonly grown in this country. It has fruited in Grant county, and is probably the most promising variety handled by all nurseyemen. The Wealthy succeeds in

the southern part of the state, but is not reliable north of Sioux Falls and Mitchell. Fine specimens of Fameuse or Snow apple are grown in Clay, Union, Yankton and Bon Homme counties, but the variety should not be planted, unless in exceptionally favorable localities, beyond their limits. The crab apple is more hardy than the standard, and it gives promise of success over a wide area. Transcendant, Hyslop, Whitney No. 20 and other varieties fruited in Brookings last season, and then there are a number of fine healthy trees in the town gardens. Unfortunately the crab is subject to blight during our bright, warm summers, but every farmer in the State should plant crab apple trees. Doubtless many of us think a crab is a poor substitute for the fine apples of our eastern homes, but the crab apple is a long, long way ahead of no apple at all. Let us plant crab apples until we can find something better.

The Russian apples have attracted a great deal of attention in the Northwest, and they have been recommended as being much more hardy than American sorts. A limited number of varieties from the long Russian list have proven more hardy than the Duchess, and these should be extensively tested throughout South Dakota. Among the hardiest of the Russian sorts are the following: Blushed Calville, Green Sweet, Revel Pear, Cinnamon, Lubsk Queen, Rosy Repka, Ukraine, Hibernial, Kremer, Silken Leaf, Juicy Burr, Ostrakoff, Lead Apple, Rosy Aport. This list is selected from the hardiest sorts noted by Professor J. L. Budd in a recent Bulletin; in all cases the varieties named above have been growing in central South Dakota from three to six years, and observations on the trees in this State, warrant the belief that all the sorts in the list are worthy of trial here. Most of them can be secured from nurseymen in this and adjoining states. Of the standard varieties commonly grown, the Duchess may be planted throughout the southern and eastern parts of the state. There may be other varieties that succeed in favorable localities, but for general planting the Duchess can be recommended.

Among crab apples and hybrids, Transcendant, though subject to blight, is a good bearer. Whitney No. 20 is a shy bearer but a fine tree. Hyslop, Brier's Sweet, Martha and Virginia can

usually be relied upon as satisfactory. All the varieties are hardy.

The plum is the most promising fruit tree for this State. I have received samples of very fine fruit from native wild groves, and the trees in the Station orchard are full of promise. The most of them are hardy and thrifty. There are between thirty and forty sorts in the Station experimental orchard of which the following are the most promising of those that have fruited: Harrison's Peach, DeSoto, Wolf.

De Soto and Harrison's Peach ripen about the same time. Last year ripe fruit of these varieties was picked September 6th. Wolf is two week's later. Harrison's Peach is a good sized plum of very fine flavor, yellow with red on sunny side. De Soto is a well known standard variety. Wolf fruited better than either of the sorts named, but its season is probably too late for the central and northern parts of the State.

Our cherry trees have not yet fruited. I am told the Early Richmond cherry is successful in the Southern counties, but it cannot be recommended for the State at large. .

A northeast slope, with rich soil and a porous clay subsoil is suitable for fruit trees. In level land a wind break on the south and west affords protection from the hot winds. In this State close planting should be practiced, the trees should stand from twelve to sixteen feet apart, thus affording mutual protection. Low tops would seem to be preferable to high standards as there is thus less liability to sunscald. When trees are first set additional protection from sunscald should be given by leaning the tree to the two o'clock sun, and by placing a board erect in the ground so as to shade the trunk of the tree during the heat of the day. Doubtless far more trees are ruined by summer killing than by cold.

When fruit trees or shrubs are received from nursery, they should be carefully root pruned, removing only bruised roots and cutting off bruised ends with a clean cut on the under side of the root. The roots should then be dipped in a mixture of fresh cow manure, soil and water, made into a thin mud. They are then ready for planting, or may be buried until they can be

planted. The roots of trees and shrubs should never be allowed to dry. If but few trees are set they can be well mulched, but in large orchards thorough cultivation is cheaper than mulching and answers the same purpose.

SMALL FRUITS.

THE STRAWBERRY.—This delicious fruit can be grown in any part of Dakota where there is sufficient water supply to enable it to perfect its fruit. At the the Station the plants grow very well, but during the past two years the weather has been very unfavorable and the crop of fruit has been small.

WHAT IS MEANT BY PERFECT AND IMPERFECT VARIETIES?—An examination of the open blossom of Wilson's Albany or Wilson strawberry, will reveal four sets of parts in the flower. In the center is a number of small light green parts, forming a rounded mass. This is the portion that becomes the fruit. Surrounding this central part are a number of little yellow organs, each borne on a tiny stem. These are the anthers and they contain the fertilizing material of the flower. Just without the anthers are the five white petals, and behind or underneath these will be found the green scales that form the calyx. Every variety of strawberry that has these four sets of parts is called a perfect variety and will produce fruit when planted alone.

But if we examine the Crescent strawberry we find that the second set named, the anthers, are not present or are abortive; that is, the Crescent flower does not contain any fertilizing material, and hence this variety is "imperfect" and will need to have a perfect kind planted with it in order to produce fruit. It is necessary to keep these facts in mind in planting a strawberry bed. I have always had good success by setting first a row of perfect-flowered sort, like Wilson, then two rows of an imperfect sort like Crescent, then a row of perfect-flowered sort, followed by two rows of imperfect, etc. As each perfect flower produces a great deal more pollen than is necessary for its own fertilization, the imperfect sorts are provided with pollen by winds and insects which carry it from the perfect flowers.

PLANTING AND CARE.—Strawberry plants should have the roots puddled, as directed for fruit trees, as soon as received from

the nursery. Fine dust should be sprinkled among the roots as soon as puddled, and if the ground is not ready for planting, the plants should be "heeled in" and the tops lightly covered with straw. If the weather is very dry when the plants are received, the bunches may be set close together in fine earth, and the plants shaded by boards which will allow a free passage of air between them and the leaves. In a few days plants so placed will push out new roots, and in this condition they are more sure to grow when set at once in the open bed.

The plants should be set from fifteen inches to two feet apart alternating perfect and imperfect sorts as heretofore suggested. The stem of the strawberry plant is extremely short, which makes careful setting necessary. The holes should be made large enough to permit the full spread of the roots, without turning the tips. The plant should be so set that the bud in the center is not covered, nor the roots exposed. Firm planting is necessary.

With careful cultivation matted rows will form the first year from plats set fifteen inches apart in the row. When the ground is frozen in the fall sufficiently to bear the weight of a wagon the entire bed, rows and spaces, should be mulched with two or three inches of clean straw or swamp grass, and this should be left on in the spring until the leaves begin to grow through it. The mulch should then be raked off the plants into the spaces. By leaving the mulch on late in the spring growth is retarded and danger from late frosts is avoided.

VARIETIES.—From tests of thirty of the older standard varieties at the Station, Crescent (imperfect) is the best early strawberry for Dakota and Windsor (imperfect), Manchester (imperfect), Glendale (perfect), and Mt. Vernon (perfect) are good later sorts. Wilson and May King are perfect sorts that will fertilize the Crescent. Probably a safe selection from the older varieties would be Crescent and Wilson for early, Manchester and Glendale a little later, Windsor and Mt. Vernon late. The first named of each set is imperfect, the other its fertilizer. None of the newer varieties have fruited at the Station. Among the new kinds that have been reported as successful in different

parts of the State the following may be mentioned: Bubach, Warfield No. 2, Gandy and Haverland. All of these are imperfect and early except Gandy, which is a perfect, late fruiting sort.

RASPBERRIES.—It is doubtful if any of the black raspberries will prove profitable, except in the south-eastern part of the state, if at all. In the Station grounds they set a good crop of fruit, but it dries and hardens before it can ripen. Fine fruit of Turner and Philadelphia, (both red sorts,) is grown in this county, and at the station the Sheffer's Colossal, a purple-red variety, is vigorous and fairly productive. Cuthbert is not hardy here. Plants in the Station grounds that have been protected in winter by bending down and covering with earth have fruited and grown better than mulched plants.

GOOSEBERRIES.—Houghton and Mountain Seedling gooseberries gave heavy crops the past season, and both sorts are hardy here. Chas Downing bears larger fruit than either of the varieties named, but it is not hardy enough for central South Dakota. Industry is a failure at the Station.

CURRANTS.—Of several varieties tested in the Station grounds Victoria is the most productive, and retains its foliage best. The Red Dutch and White Dutch also bear good crops. Cherry and Versaillaise, (red) and White grape are not as good bearers as the sorts named. Both currants and gooseberries should be extensively planted. They may be regarded as pioneer fruits, and will stand roughing it better than any other fruits we have. They are benefitted by heavy mulching and liberal manuring.

BLACKBERRY.—Stone's Hardy, one of the hardiest varieties of the blackberry in cultivation, has entirely failed at this station.

DEWBERRY.—This is a trailing form of the blackberry, and where it can be sheltered from the hot summer winds it should prove successful. The Windom originated in south-west Minnesota, was loaded with fruit on the station grounds last season, but the plants were fully exposed to the wind and sunshine, and comparatively few fruits matured. The mature fruit resembles the blackberry in size and flavor. It is a promising fruit

for South Dakota if covered in winter by and planted in a protected place.

GARDEN VEGETABLES.

The experiments which have been made during the past three years have had for their object the determination of the adaptability of well known garden vegetables to the climate and soil of South Dakota. In endeavoring to sum up results for the period named, two facts seem thoroughly demonstrated. First, the prairie soil of South Dakota, essentially the same throughout the state, is especially adapted to the cultivation of almost all garden vegetables; and second, that our range of choice is limited chiefly by the water supply, both in soil and air, and in less degree by other climatic conditions.

Such garden crops as mature in a comparatively short growing season, and whose edible portions are seeds or roots, are successful with us. Succulent fruits, such as the tomato, and crops that require a great amount of rain, as the cabbage, are uniformly unprofitable or are precarious.

Vegetables, in the growth of which good culture can compensate to the necessary degree for a limited rainfall, have proven successful.

As to varieties, our experiments indicate what one would naturally expect to find, that early sorts are more uniformly successful than late kinds.

The vegetable garden should be thoroughly enriched with well rotted barn yard manure. A black soil with sand and porous subsoil is best, and the early vegetables at least, like plenty of sunshine.

Of garden roots or perennial vegetables, rhubarb, asparagus, and horse radish should have their place in every garden. Horse radish will thrive under neglect, but rhubarb and asparagus require very rich soil for best results. Asparagus succeeds best in low situations, if the soil be well drained and warm. The one or two-year-old plants can be purchased of nursery men, or the seed may be sown in drills, the one-year-old plants being set in beds the following spring. The soil should be spaded deep and

manured freely, and the plants set not closer than eighteen inches, and covered about four inches deep. Conovor's Collossal is the standard variety. Palmetto is said to be an improvement.

Rhubarb will flourish in any good soil. It should have a good dressing of rotted manure every year. It should be planted where it will get the spring sun, as the product is most relished early in the season. Linneus is the best sort. It is usually propagated by division of the roots, which may be secured from nurserymen.

GARDEN VEGETABLES.

Simple directions for the cultivation of garden vegetables and for the making of hot beds are contained in almost all seedsmen's catalogues, and these are in the main applicable to South Dakota. During the past two seasons the time of planting different vegetables at the station has been as follows:

Seeds in hot beds, April 1st, celery, early cabbage, tomatoes, cauliflower, peppers. In the garden, middle of April, lettuce, early radish, spinach, early peas, onions, beet, carrot, parsnip, salsify.

Middle of May: Early cabbage and cauliflower, (transplanted from hot beds,) late radish, succession peas, sweet corn, cucumber, squash, beans, melons.

Last of May: Tomatoes transplanted from hot beds.

Last of June: Late cabbage and celery, (transplanted from cold frames,) succession peas and beans.

VARIETIES.—The following list of varieties of garden vegetables is given to enable planters who may not be familiar with the different forms to select such as will probably be satisfactory. It is not claimed that the very best of each class has been named, as we have not yet tested all the different kinds offered by seedsmen. But every vegetable mentioned in the list has been tested in our gardens, and has proven valuable:

Bean:—Wardwell's Wax, White Wax, Henderson's Dwarf Lima, Prylific Tree, (for winter.)

Beet:—Mitchell's Improved, Eclipse.

Cabbage:—Extra Early Jersey Wakefield, Henderson's Summer, Flat Dutch, (for winter.)

Carrot:—Danver's Half Long.

Cauliflower:—Snowball.

Celery:—White Plume, (early,) Solid Ivory and New Rose, (late keepers.)

Corn, Sweet:—Cory, (earliest,) Minnesota, Stowell's Evergreen.

Cucumber:—Improved White Spine.

Lettuce:—White Seeded Tennis Ball, Hanson.

Melon-Canteloupe:—Early Hackensack, Osage.

Okra:—Dwarf White Velvet

Onion:—White Silver Skin, Yellow Danvers, Red Weathersfield.

Parsley:—Fern Leaved.

Pea:—Early Alaska, American Wonder, Yorkshire-Hero, Stratagem, (late.)

Pepper:—Bull Nose.

Radish:—French Breakfast, (small early,) Long Scarlet Short Top, (Second) White Strausburg, (summer.)

Salsify:—Mammoth Sandwich Island.

Spinach:—Long Standing.

Squash:—Summer-Crookneck; winter-Boston Marrow, Bay State, Hubbard,

Tomato:—Alpha, Dwarf Champion, Ignatum.

Turnip:—Purple Top Sharp Leaf.

In the above list, when more than one variety is named the first is the earliest, and the others follow in order of maturity or keeping qualities.

PLANT A GARDEN.

There is always a tendency in a new country, for the farmer to put all his energies into the work of the field crops, and to neglect entirely the fruit and vegetable garden. Probably there is a much larger number of farms in this state without gardens than with them, and yet for the amount of land and effort required, no part of the farm brings as high a return as a good garden. The farm garden should be convenient to the house, and so plan-

ned that nearly all the work can be done with the cultivator. Let everything, even including onions, be planted in drills or rows from thirty inches to three feet apart, and a few turns with the cultivator on the way to the corn field will keep the garden in good growing condition. The added variety to the bill of fare that a good garden will afford, will insure increased health and comfort to every family; and there is almost always a surplus of vegetables, which command a good price in all the towns of the state.





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